

Glenn Counties (California Natural Diversity Data Base 2001 and unprocessed data). Five occurrences are afforded some protection by virtue of their location on public land, but no particular conservation efforts have been undertaken in those areas.

## **2. *ASTRAGALUS TENER* VAR. *TENER* (ALKALI MILK-VETCH)**

### **a. Description and Taxonomy**

***Taxonomy.***—Alkali milk-vetch is in the pea family Fabaceae. Gray (1864) named *Astragalus tener*, commonly known as alkali milk-vetch. He gave the type locality only as “California ... from near Monterey or San Francisco” (Gray 1864:206). No varieties were named until Barneby (1950) reduced *Astragalus titi*, commonly known as coastal dunes milk-vetch, from a full species to the variety *Astragalus tener* var. *titi*. In so doing, the combination *Astragalus tener* var. *tener* was created automatically to represent Gray’s original material (*i.e.*, alkali milk-vetch), according to accepted rules of botanical nomenclature. Another common name by which this variety is known is slender rattle-weed (Abrams 1944).

***Description and Identification.***—*Astragalus tener* var. *tener* (**Figure II-22**) is similar in most respects to *A. tener* var. *ferrisiae*. However, the two taxa differ in leaflet shape and fruit morphology. *Astragalus tener* var. *tener* leaflets vary, even on the same plant, from narrow and pointed to wedge-shaped with blunt or notched tips. In *A. tener* var. *tener*, the pod is only 1 to 2.5 centimeters (0.4 to 1.0 inch) long and straight or only slightly curved. The base of the pod is typically rounded; if stalk-like, the base is much less than 3 millimeters (0.12 inch) long. Also, the fruits are deflexed all the way to the stem of the inflorescence. *Astragalus tener* var. *tener* pods contain between 8 and 14 seeds (Gray 1864, Liston 1990*b*, A. Liston *in litt.* 1993, Spellenberg 1993). The plants have a diploid chromosome number of 22 (Liston 1992).

The variable leaflets and shorter, straighter pods, which are more strongly deflexed, distinguish *Astragalus tener* var. *tener* from *A. tener* var. *ferrisiae* (Liston 1990*b*, A. Liston *in litt.* 1993, Spellenberg 1993). *Astragalus tener* var. *titi* has a shorter banner (5.2 to 6 millimeters [0.20 to 0.24 inch] long) and only 5 to 11 seeds per pod (Spellenberg 1993). This species can be distinguished from all other species of *Astragalus* that occur in the same areas by its deflexed fruit stalks and smooth seeds (Liston 1992). Additional identifying features were given in the *A. tener* var. *ferrisiae* account presented earlier in this document.



**Figure II-22.** Illustration of *Astragalus tener* var. *tener* (alkali milk-vetch). Reprinted with permission from Abrams (1944), *Illustrated Flora of the Pacific States: Washington, Oregon, and California*, Vol. II. © Stanford University Press.

## b. Historical and Current Distribution

**Historical Distribution.**—*Astragalus tener* var. *tener* formerly occurred in the Central Coast, Lake-Napa, Livermore, San Joaquin Valley, Solano-Colusa, and Santa Rosa Vernal Pool Regions (Keeler-Wolf *et al.* 1998), as well as in several locations outside of the named regions (**Figure II-23**). Between 1864 and the early 1980s, collections were made in more than 40 separate sites within 13 counties, ranging from the Salinas Valley and the San Francisco Bay area to the Central Valley (Barneby 1950, Liston 1989). Populations in the San Francisco Bay and Sacramento-San Joaquin Delta areas were being extirpated by the mid-1960s, but additional sites were discovered in the Central Valley after that time (Liston 1989, Skinner and Pavlik 1994, California Natural Diversity Data Base 2001). Alameda and Solano Counties had the largest number of historical collection sites, with 10 each, followed by Yolo County with 9 sites. Specimens were collected from two sites each in Contra Costa, Santa Clara, and San Joaquin Counties. *Astragalus tener* var. *tener* was known from one site each in Merced, Monterey, Napa, San Benito, San Francisco, Sonoma, and Stanislaus Counties prior to 1988 (A. Liston *in litt.* 1988, California Natural Diversity Data Base 2001).

**Current Distribution.**—Of the 66 occurrences of *Astragalus tener* var. *tener* that have been reported, 36 are presumed to be extant (A. Liston *in litt.* 1988, California Natural Diversity Data Base 2005). Twenty-three of those were discovered within the past decade. The majority of the extant occurrences are in the Solano-Colusa Vernal Pool Region (Keeler-Wolf *et al.* 1998); most are in the Dozier-Fairfield area of Solano County, but three are southeast of Woodland in Yolo County (C. Witham *in litt.* 1990, California Natural Diversity Data Base 2001). Eight other occurrences of *A. tener* var. *tener* are clustered between Merced, Newman, and Los Banos in north-central Merced County (Silveira 1996, California Natural Diversity Data Base 2005), which is in the San Joaquin Valley Vernal Pool Region (Keeler-Wolf *et al.* 1998). The single occurrence of *A. tener* var. *tener* that remains in the Lake-Napa Vernal Pool Region is located in Napa County (Keeler-Wolf *et al.* 1998, California Natural Diversity Data Base 2005). The other extant occurrence, at Albrae in the Central Coast Vernal Pool Region, was considered to be “possibly extirpated” until about 40 plants were rediscovered in a created pool there in 1999 (California Natural Diversity Data Base 2001).

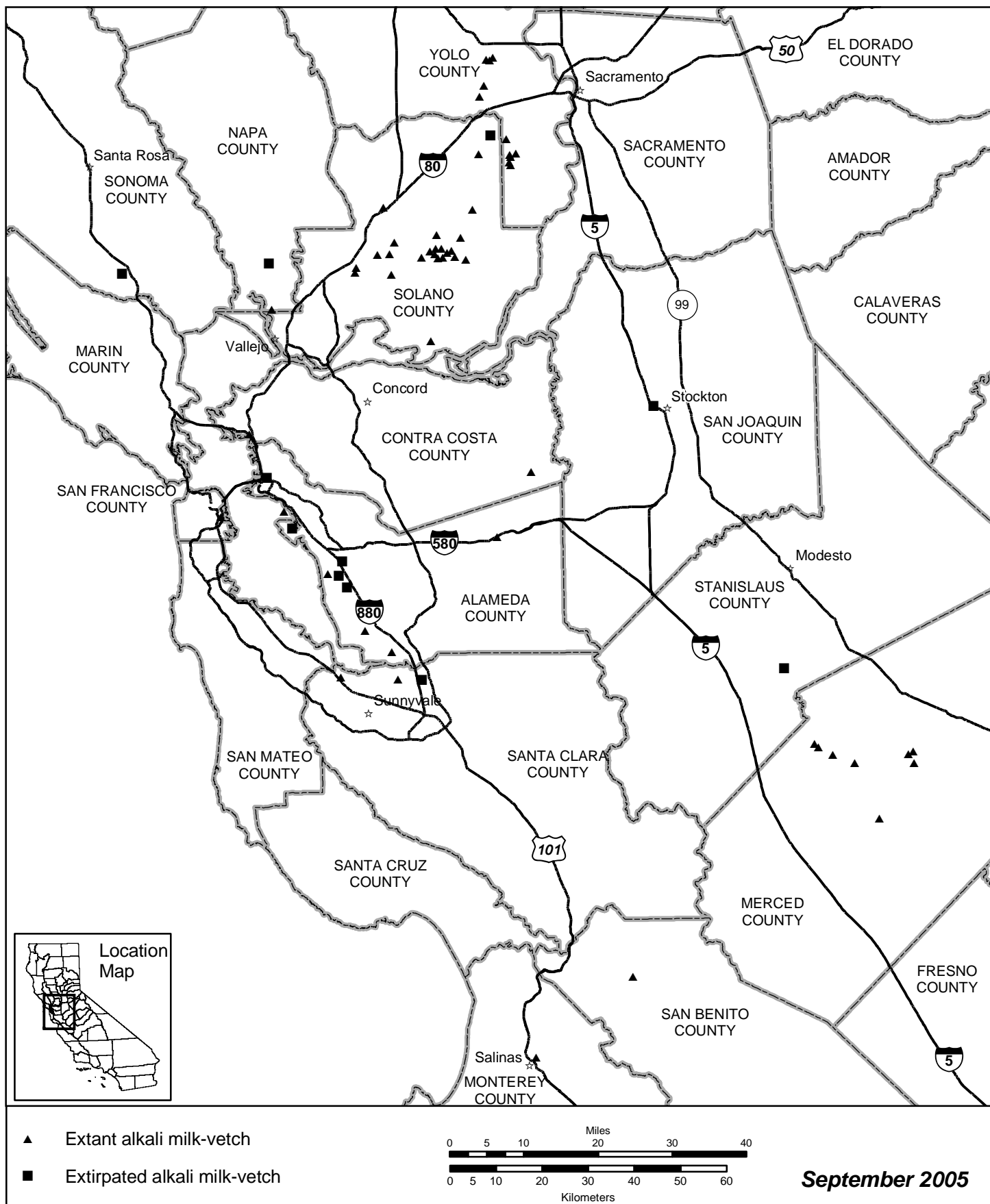


Figure II-23. Distribution of *Astragalus tener* var. *tener* (alkali milk-vetch).

### c. Life History and Habitat

**Reproduction and Demography.**—The dates and conditions under which seeds of *Astragalus tener* var. *tener* germinate are not known. *Astragalus tener* var. *tener* flowers from March through June (Skinner and Pavlik 1994). The plants become inconspicuous within a few weeks of flowering (C. Witham *in litt.* 1993, A. Liston *in litt.* 2000). As described under the *A. tener* var. *ferrisiae* account, the probable pollinators are butterflies. However, C. Witham (*in litt.* 2000a) noted that butterflies are not common in the grassland habitats of *A. tener* var. *tener*. Liston's (1992) genetic studies indicated that plants within a population crossed randomly and did not suffer from excessive inbreeding, even though individual pistils can be fertilized by pollen from the same plant. *Astragalus tener* var. *tener* did not produce seeds when crossed experimentally with *A. tener* var. *titi* or with other closely-related species (Liston 1992). Seed dormancy and dispersal in *A. tener* were discussed in the *A. tener* var. *ferrisiae* account.

Based on analysis of proteins, Liston (1992) determined that *Astragalus tener* var. *tener* had more genetic variation within populations than the other six taxa in his study, although genetic diversity was low in the entire group. Genetic diversity among populations of *A. tener* var. *tener* was minimal. He also determined that *A. tener* var. *tener* and *A. tener* var. *titi* were very similar genetically. Unfortunately, *A. tener* var. *ferrisiae* was not available for inclusion in Liston's study because no populations were known to be extant at that time. Collectively, the two varieties of *A. tener* that Liston studied had two gene forms that were not found in the other five taxa (Liston 1992).

The demography of this taxon has not been investigated in detail. However, monitoring results indicated that populations could change by two orders of magnitude from one year to the next, as in one Solano County population that increased from 4 plants in 1993 to 350 in 1994 (California Natural Diversity Data Base 2001). Of the populations whose sizes have been estimated, 6 had fewer than 100 plants at maximum, 6 others numbered between 100 and 500 plants, and 1 had more than 500 (California Natural Diversity Data Base 2001).

**Habitat and Community Associations.**—The range of plant communities in which *Astragalus tener* var. *tener* has been found is indicative of its broad geographic range. This taxon has been reported from vernal pools and playas, edges of salt marshes, alkali meadows, and moist grassy flats (California Natural Diversity Data Base 2001). The vernal pool types in which it grows are Northern Basalt Flow, Northern Claypan, Northern Hardpan, and Northern Volcanic

Ashflow (Sawyer and Keeler-Wolf 1995). Optimum pool depth, duration, and area are unknown.

Soil types have been reported for only a few *Astragalus tener* var. *tener* occurrences in the Solano-Colusa Vernal Pool Region; those in Solano County are Solano-Pescadero and Pescadero clay, whereas one in Yolo County is Capay silty loam. The sites where this taxon grows typically are alkaline. Current and historical *A. tener* var. *tener* sites range in elevation from 1.5 to 88 meters (5 to 290 feet); one vaguely described site may have been 168 meters (550 feet) in elevation (California Natural Diversity Data Base 2001).

The species associated with *Astragalus tener* var. *tener* vary throughout its range. Plants that have been reported to occur with *Astragalus tener* var. *tener* in two or more of the vernal pool regions are *Bromus* spp. (bromes), *Castilleja densiflora* (dense-flowered owl's-clover), *Downingia pusilla* (dwarf downingia), *Lasthenia* spp. (goldfields), *Layia chrysanthemoides* (vernal pool layia), *Myosurus minimus*, and *Psilocarphus oregonus* (Oregon woolly-heads). In the Solano-Colusa Vernal Pool Region, from which multiple reports were available, the most frequent associates of *Astragalus tener* var. *tener* are *Lepidium latipes* var. *latipes* (dwarf peppergrass), *Lasthenia fremontii*, and *Distichlis spicata*, in order of frequency. Among the other plants featured in this recovery plan, those occurring in the same pools with *Astragalus tener* var. *tener* throughout its range include *Lasthenia conjugens*, *Neostapfia colusana*, *Atriplex persistens*, and *Legenere limosa*. In addition, *Chamaesyce hooveri*, *Tuctoria mucronata*, and *Gratiola heterosepala* grow in some of the same vernal pool complexes as *Astragalus tener* var. *tener*, but in different pools. The endangered *Cordylanthus palmatus* (palmate-bracted bird's-beak) occurs with *Astragalus tener* var. *tener* near Woodland (California Natural Diversity Data Base 2001), but this species is included in a different recovery plan (U.S. Fish and Wildlife Service 1998a).

#### **d. Reasons for Decline and Threats to Survival**

Most species addressed in this recovery plan are threatened by similar factors because they occupy the same vernal pool ecosystems. These general threats, faced by all the covered species, are discussed in greater detail in the Introduction section of this recovery plan. Additional, specific threats to *Astragalus tener* var. *tener* are described below.

Agricultural conversion remains a threat to *Astragalus tener* var. *tener* (Skinner and Pavlik 1994). However, anecdotal evidence suggests that *A. tener* var. *tener* may benefit from some types of temporary surface disturbance. It was observed growing above a recently buried pipeline at two different sites, probably because the disturbance temporarily reduced the cover of competing plants (C. Witham in

*litt.* 1998). *Astragalus tener* var. *tener* also appeared in a created vernal pool near Albrae, where it had not been observed since 1923 (California Natural Diversity Data Base 2001).

Grazing by cattle, sheep, or horses has been mentioned as a possible threat at 10 occurrences. However, all of the grazed populations were rated as being in “good” to “excellent” condition, including two used as permanent cattle pastures (California Natural Diversity Data Base 2001). Moreover, grazing may be necessary to reduce competition, for example from invasives such as filaree (*Erodium* species) at the Arena Plains Unit of the Merced National Wildlife Refuge in Merced County (J. Silveira *in litt.* 2000). Competitors that threaten *A. tener* var. *tener* include *Lepidium latifolium* and *Salsola* spp. (Russian thistle) in Yolo County, and *Melilotus indica* (sweet clover) and *Lolium multiflorum* in Alameda County (California Natural Diversity Data Base 2001). Extirpation from random processes is also a threat to virtually all of the populations due to their small numbers of plants, which make them vulnerable to chance events. Loss of pollinators due to destruction or degradation of their habitat also is a threat to *A. tener* var. *tener* because it would not be able to set seed if pollinators were absent. Threats specific to the Yolo County site where *A. tener* var. *tener* grows near *Tuctoria mucronata* were described under the description of the latter species. A fire burned through one of these occurrences in 2003 and construction of large stormwater retention basins for the Springlake development project impacted another. Soil that supported *A. tener* var. *tener* was salvaged from the basin footprint and translocated to a nearby site. *Astragalus tener* var. *tener* was not observed at the burn site in 2003 or 2004. The status of the seedbank at the translocation site is not known (M. Showers *in litt.* 2005).

#### **e. Conservation Efforts**

*Astragalus tener* var. *tener* currently is neither federally- nor State-listed. The California Native Plant Society did not consider it to be a rare taxon until 1994; it is now on List 1B and is regarded as endangered in a portion of its range (Skinner and Pavlik 1994). Dr. Aaron Liston visited historical sites and conducted research on the breeding systems and genetics of *A. tener* var. *tener* and related taxa (A. Liston *in litt.* 1988, Liston 1989, Liston 1990a, Liston 1992). Carol Witham undertook surveys for *A. tener* var. *tener* in Solano and Yolo Counties beginning in 1990 and discovered many of the populations now known (C. Witham *in litt.* 1990, C. Witham *in litt.* 1993, California Natural Diversity Data Base 2001). Additional populations were found during surveys for other vernal pool plants (California Natural Diversity Data Base 2001) and during pre-construction surveys for a gas pipeline (BioSystems Analysis 1994).

Twelve occurrences of *Astragalus tener* var. *tener* occur on sites protected by conservation organizations or on public land. Three are within the Jepson Prairie Preserve in Solano County (C. Witham *in litt.* 1990, California Natural Diversity Data Base 2001). Two occurrences are on the Wilcox Ranch in Solano County, part of which is owned and managed by The Nature Conservancy and the other part of which is owned and managed by Solano County (J. Marty, pers. comm. 2004). Four occurrences are on Federal or State wildlife areas in Merced County: the Arena Plains Unit of the Merced National Wildlife Refuge, Kesterson National Wildlife Refuge, the Los Banos Wildlife Management Area, and the North Grasslands Wildlife Management Area (Silveira 1996, California Natural Diversity Data Base 2001). *Astragalus tener* var. *tener* grows on land administered by the U.S. Department of Defense at Travis Air Force Base in Solano County and the U.S. Air Force Communications Facility in Yolo County (California Natural Diversity Data Base 2001). Also, one Yolo County occurrence is on property protected by a conservation easement with the City of Woodland (C. Witham *in litt.* 1990, California Natural Diversity Data Base 2001). However, this taxon is not necessarily protected simply by virtue of existing on public lands. No particular management activities have been undertaken for *A. tener* var. *tener*, and monitoring is sporadic.

### 3. *ATRIPLEX PERSISTENS* (VERNAL POOL SMALLSCALE)

#### a. Description and Taxonomy

**Taxonomy.**—This species is in the goosefoot family (Chenopodiaceae). Vernal pool smallscale was recognized as a unique species only recently. Stutz and Chu (1993) gave it the scientific name *Atriplex persistens*. Specimens of vernal pool smallscale collected prior to publication of the name had been incorrectly assigned to Parish's brittlescale (*Atriplex parishii*), a southern California species. The type locality of vernal pool smallscale is "Glenn Co., 5 miles S of Willows, 1/4 mi SW of Sacramento Wildlife Refuge Headquarters" (Stutz and Chu 1993:211). Other common names by which it is known are vernal pool saltbush (Silveira 1996, Keeler-Wolf *et al.* 1998) and persistent-fruited saltscale (California Department of Fish and Game 1999, California Natural Diversity Data Base 2001).

**Description and Identification.**—*Atriplex persistens* (**Figure II-24**) is an annual. The plants appear silvery-green (Silveira 1996) because the leaves and branches are covered with whitish, mealy scales. The 10- to 20-centimeter (4- to 8-inch) long stems may be upright or curved outward, and the branches originate from the base. *Atriplex persistens* has alternate, stalkless leaves 2 to 4 millimeters (0.08 to 0.16 inch) long. The leaves are basically egg-shaped with smooth margins, although their bases range from heart-shaped to triangular. Male and